EDITORIAL

nature cell biology

Credit where credit is due

Citations are an important component in the assessment of academic performance. Yet, the growing literature, combined with format constraints of journals, encourage citation of reviews in preference to primary research. This diverts academic credit from the discoverer.

Scientific research continues to accelerate, mirrored by unprecedented publication rates: PubMed contains over 18 million citations now. In many fields it is becoming increasingly difficult to cite the literature appropriately. As fields mature, they accumulate larger volumes of back literature and all too often, multiple papers report related findings. Both factors pose a challenge for comprehensive and systematic reference lists. Yet the format of papers in most journals, including NCB, has not changed significantly, encouraging selective or secondary literature citation.

The pressure on researchers is higher than ever before and many find themselves chronically short of time. A lamentable but largely unavoidable by-product of the cocktail of specialization, accelerated research activity and increased overall scientific output is that browsing the literature is on the decline, in favour of keyword-directed access to information. Search engines, such as PubMed and Google Scholar, do allow reliable access to specific information, and browsing is aided by text-comparison engines. The information overload of increasingly specialized researchers has precipitated a rapid growth of the review literature. Reviews have replaced browsing as a means to stay abreast of scientific progress beyond one's area of specialization. The increased reliance on the review literature to access information has led to a tendency to cite reviews, rather than the underlying primary literature. Assuming the review is authoritative and comprehensive, this still removes the reader one or more steps from the relevant original work, and many will not have the time to trace the primary citation(s). Importantly, every paper that does not directly cite the initial report of a finding, takes away academic credit from the discoverer, often directly affecting his or her funding and career.

Even when citing the primary literature, there is evidence that authors, on occasion, simply transfer citations from other papers they have read. A fascinating estimate of the prevalence of this practice was provided by a study that measured the transmission of typographical errors in the 4,300 citations to a 1973 paper on condensed-matter physics, concluding that about 78% of the references were transcribed from other reference lists, rather than the original source article (Simkin, M.V. & Roychowdhury, V.P. *Complex Syst.* **14,** 269; 2003; see also *Nature* **420,** 594; 2002). If this applies to cell biology, it may point to a troublesome culture of cutting-and-pasting in preference to reading the primary literature. This may consequently inflate the citation of certain papers and distort the scientific record (see also *Nature* **423**, 373–373; 2003). Needless to say, this journal requests that authors evaluate the paper cited, rather than take someone else's word for it. This is particularly important when writing reviews, which tend to set certain beliefs in stone.

In the last issue of NCB, 26% of all citations were to reviews (9.1 ± 4.1 (s.d.) of 34.5, $n = 11$), compared with 21% in the inaugural issue of NCB in 1999 (8.3 ± 3.9 of 40.2, $n = 11$). Notably, papers ranged between 11 and 52% in review citation rate. It is worth noting that reviews also contain a significant fraction of citations to other reviews (around 20% in a random sample of *Nature Reviews* articles). Two issues encourage review citation: 1) most journals have rather compact citation lists. Citing reviews often allows an author to 'kill several birds with one stone', and it is a technique to stay within restrictive citation limits. 2) ISI (Thomson Scientific) continues to lump together citations of primary research papers and reviews. This has had a major impact on researchers and indeed journals: it boosts cumulative citations of the former, while providing papers that tend to be well-cited for the latter to beef up journal impact factors. We have argued previously for a disambiguation of primary and review citations (October 2005 editorial).

An additional consideration is that in the current highly competitive world of cell biology, some researchers may be tempted to obfuscate the state of the field to enhance the apparent conceptual advance provided by their study. Rather than omitting a citation altogether, a less onerous approach may be to support a vague statement by citing a general review.

We aim to address this important issue in the two ways. First, we have increased the reference limits on our papers by 40%. In the 'Article' format, authors can now cite up to 70 references, rather than 50; for 'Letters', 40 instead of 30, and 20 references for 'Brief Communications'. Our 'Reviews' can now contain 140 instead of 100 references and 70 for 'Perspectives'. Second, we strongly encourage authors to cite the primary literature where appropriate. Clearly, citing reviews is the only effective way to provide background information on whole fields (for example, 'cell migration' or 'enzymology of the ubiquitin-proteasome system') or more focussed topics with a considerable literature (for example, 'role of ATM in the DNA damage response'). In fact, citing a review for this purpose is far more appropriate than a random selection of primary papers. However, where specific findings are concerned, references to the primary literature must be included (for example 'Ser 46 phosphorylation of p53 regulates apoptosis'). Needless to say, in many cases, such as the p53 example provided, the literature may be large, complex and indeed sometimes contradictory. Although previous discussion of a finding provides invaluable help in navigating the literature, it is the authors' responsibility to re-read the primary literature and to cite it where and as appropriate. If the primary report lies far back (say ten years) it is also often appropriate to cite a review that contextualizes the finding.

Although there can be no absolute rules for primary and secondary literature citation, we will monitor citations increasingly at the editorial level and request that authors adapt their citations where appropriate.

The *EMBO Journal* has just announced a similar policy (*EMBO J.* doi: 10.1038/emboj.2008.250) and the hope is that these policies will encourage more direct and more accurate citation, which will enhance academic accountability. Give credit where credit is due.